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Original Article / Özgün Makale

Unusual variants of primary malignant esophageal tumors

Özofagusun primer malign tümörlerinin nadir varyantları

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ABSTRACT

Background: This study aims to discuss the features of a group of patients with rare malignant tumors of the esophagus in the light of the literature.

Methods: Of a total of 953 patients diagnosed with esophageal cancer between January 2000 and March 2014 in Atatürk University, Faculty of Medicine, Department of Thoracic Surgery, 37 patients (14 males, 23 females; mean age 63.7±12.1 years; range 20 to 87 years) with rare primary malignant tumors of the esophagus were included in the study. We assessed the patients retrospectively according to age, sex, histological type, tumor localization, treatment administered, tumor stage, and survival. Esophagoscopy, tomography, esophageal barium X-ray, abdominal ultrasonography, and positron emission tomography and computed tomography were performed for diagnosis and staging purposes.

Results: Of the patients, 19 had adenosquamous cell carcinoma, nine had neuroendocrine cell carcinoma, four had basaloid squamous cell carcinoma, two had carcinosarcoma, one had mucoepidermoid carcinoma, one had adenoid cystic carcinoma, and one had leiomyosarcoma. Due to limited disease, esophagectomy was performed to 19 patients. Survival rate was better in patients who were performed esophagectomy ($p<0.05$).

Conclusion: In terms of clinical features, rare tumors of the esophagus have common features with squamous cell carcinoma and adenocarcinoma of the esophagus. In these tumors, the most important factor affecting survival is the esophagectomy performed at an early stage.

Keywords: Adenosquamous carcinoma; esophageal cancer; esophagectomy; neuroendocrine carcinoma.

ÖZ

Amaç: Bu çalışmada özofagusun nadir görülen malign tümörleri olan bir grup hastanın özellikleri literatür eşliğinde tartışıldı.

Çalışma planı: Atatürk Üniversitesi Tıp Fakültesi Göğüs Cerrahisi Bölümünde Ocak 2000 - Mart 2014 tarihleri arasında özofagus kanseri tanısı konulan 953 hasta içinden nadir primer malign özofagus tümörü olan 37 hasta (14 erkek, 23 kadın; ort. yaş 63.7±12.1 yıl; dağılım 20-87 yıl) çalışmaya dahil edildi. Hastalar yaş, cinsiyet, histopatolojik tip, tümörün yerleşim yeri, uygulanan tedavi, tümör evresi ve sağ kalıma göre retrospektif olarak değerlendirildi. Tanı ve evreleme amacıyla özofagoskopi, tomografi, baryumlu özofagus grafisi, batın ultrasonografisi ve pozitron emisyon tomografisi ve bilgisayarlı tomografi uygulandı.

Bulgular: Hastaların 19'unda adenoskuamöz hücreli karsinom, dokuzunda nöroendokrin hücreli karsinom, dördünde bazaloid skuamöz hücreli karsinom, ikisinde karsinosarkom, birinde mukoepidermoid karsinom, birinde adenoid kistik karsinom ve birinde leiyomyosarkom vardı. Sınırlı hastalık olmasından dolayı 19 hastaya özofajektomi uygulandı. Özofajektomi uygulanan hastalarda sağkalım oranı daha iyi idi ($p<0.05$).

Sonuç: Özofagusun nadir tümörleri, klinik özellikler bakımından özofagusun skuamöz hücreli karsinomu ve adenokarsinomu ile ortak özelliklere sahiptir. Bu tümörlerde, sağkalımı etkileyen en önemli faktör erken evrede uygulanan özofajektomidir.

Anahtar sözcükler: Adenoskuamöz karsinom; özofageal kanser; özofajektomi; nöroendokrin karsinom.

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Rare primary malignant tumors of the esophagus consist of a large group of malignancies such as leiomyosarcoma, malignant melanoma, carcinosarcoma, mucoepidermoid, granular cell, neuroendocrine cell, adenosquamous cell, basaloid squamous cell and adenoid cystic carcinoma.[1-9] These tumors may be disseminated lymphogenously and hematogenously as in typical esophageal cancers and may affect the adjacent organs through direct invasion. Tumors that can originate from different layers of the esophagus have common clinical and histopathological features with squamous cell carcinoma and adenocarcinoma. However, clinical and histopathological features and standard treatment regimens of these tumors have not been fully identified yet due to their rarity. To our knowledge, no staging system is available for such tumors whereas tumor necrosis metastasis (TNM) staging is used for adenocarcinoma and squamous cell carcinomas.[10] In this study, we aimed to discuss the features of a group of patients with malignant tumors of the esophagus in the light of the literature.

PATIENTS AND METHODS

The study included 37 patients (14 males, 23 females; mean age 63.7±12.1 years; range 20 to 87 years) with rare primary malignant tumors of the esophagus out of a total of 953 patients diagnosed with esophageal cancer between January 2000 and March 2014 in Atatürk University, Faculty of Medicine, Department of Thoracic Surgery. Of the 953 patients, 292 underwent esophagectomy. We assessed the patients retrospectively according to age, sex, histological type, localization, treatment administered, stage and survival. In tumor staging, we used the sixth TNM staging. The patients' characteristics were shown in Table 1. The symptoms were dysphagia (n=37), weight loss (n=11), fatigue (n=6), and retrosternal chest pain (n=1). Esophagoscopy, tomography, esophageal barium X-ray, abdominal ultrasonography, and positron emission tomography and computed tomography were performed for diagnosis and staging purposes. The most common variant was adenosquamous carcinoma (51.3%, n=19). The tumor was localized in distal esophagus in 22 patients, whereas it was localized in medium esophagus in 15 patients. Due to limited disease, esophagectomy was performed on totally 19 patients (51.3%) (eight with adenosquamous cell carcinoma, four with basaloid squamous carcinoma, two with carcinosarcoma, two with neuroendocrine cell tumor, one with adenoid cystic carcinoma, and one with leiomyosarcoma). No morbidity or mortality was observed in any of the patients who underwent esophagectomy. Eighteen patients deemed "unfit for operation" and received chemoradiotherapy. Self-expandable metallic stent was inserted to five patients in whom palliation of dysphagia could not be achieved with chemoradiotherapy. After esophagectomy, the following stages were identified: stage I in one patient, stage IIA in nine patients, stage IIB in five patients, and stage III in four patients. The study protocol was approved by the Medical Faculty of Atatürk University Ethics Committee. Written informed consent was obtained from each patient, and the study was conducted in accordance with the principles of the Declaration of Helsinki.

Statistical analysis

The data were analyzed using the IBM SPSS version 20.0 (IBM Corporation, Armonk, NY, USA) statistical software. The results were given in number, percentage, mean, standard deviation, standard error, and 95% confidence interval. The effect of treatment, histologic type, age, sex, tumor localization, and tumor stage on survival was analyzed by Kaplan-Meier (log-rank) method and the statistical significance level was considered to be $p<0.05$.

RESULTS

The ratio of patients with rare tumor was 3.8%. Most patients were female (62.1%, n=23) over 40 years of age (91.8%, n=34) who had dysphagia (100%, n=42). The mean age of 19 patients with adenosquamous cell carcinoma was 61.1 years (range 20 to 77 years) and female-to-male ratio (F/M) was 10/9. The tumor was

Table 1. Patients' characteristics

Patients characteristics	n	%	Mean±SD
Age (years)			63.7±12.1
Gender			
Male	14	37.8	
Female	23	62.2	
Histopathology			
Adenosquamous cell carcinoma	19	51.4	
Neuroendocrine carcinoma	9	24.3	
Basaloid squamous cell carcinoma	4	10.8	
Carcinosarcoma	2	5.4	
Mucoepidermoid carcinoma	1	2.7	
Leiomyosarcoma	1	2.7	
Adenoid cystic carcinoma	1	2.7	
Tumor location			
Middle	15	40.5	
Distal	22	59.5	
Treatment			
Resection	19	51.4	
Others	18	48.6	

SD: Standard deviation.

localized in the distal esophagus in 13 patients and in the mid-esophagus in six patients. We observed dysphagia in 19 (51.3%), weight loss in seven (18.9%), and fatigue in two (5.4%) patients. The following stages were identified with esophagectomy: Four patients with stage IIA, three patients with stage IIB, and one patient with stage III. Unresected patients were given chemoradiotherapy. Esophageal stent was inserted to three patients in whom palliation of dysphagia was not achieved after chemoradiotherapy. The mean survival rate was 27.8±7.5 months and the three and five-year survival rates were calculated to be 28.9% and 14.5%, respectively.

The mean age of nine patients with neuroendocrine cell tumors was 61.3 years (range 41 to 87 years) and the F/M ratio was 4/5. The tumor was localized in the distal esophagus in eight patients and in the medium esophagus in one patient. We observed dysphagia in nine (24.3%), weight loss in two (5.4%), and fatigue in two (5.4%) patients. The two patients who underwent esophagectomy were reported to be in stage IIA and stage III. Seven patients received chemoradiotherapy. Stent was inserted to two patients in whom dysphagia did not improve. The mean survival rate was calculated as 11.5±3.1 months.

The mean age of the four patients with basaloid squamous cell carcinoma was 59.2 years (range 36 to 71 years), and all of the patients were female. In two patients, the tumor was localized in the distal esophagus whereas it was localized in the medium esophagus in the two other patients. We observed dysphagia in four (10.8%), weight loss in one (2.7%), and fatigue in one (2.7%) patient. All patients in this group underwent esophagectomy. Their pathological stages were reported as stage IIA in two patients, stage IIB in one patient, and stage III in one patient. In these patients, the mean survival rate was 35.3±11.9 months.

The two patients with carcinosarcoma were 60 and 75 years old, and both of them were female. Dysphagia was present in both patients whereas one patient also had fatigue and weight loss. In both patients, the tumor was localized in the medium esophagus and they both underwent esophagectomy. Their pathologic stages were reported to be stage IIB and stage III. The 60-year-old patient at stage IIB is in her postoperative 81st month and still alive. Another patient is alive for eight months.

Patients with mucoepidermoid carcinoma, adenoid cystic carcinoma, and leiomyosarcoma were 82, 59, and 46 years old, respectively. While all patients had dysphagia, the patient with leiomyosarcoma also had retrosternal chest pain. The tumor was localized in the mid-esophagus in all of these patients. All of the patients underwent esophagectomy. Their pathological stages were found to be stage IIA, stage I, and stage IIA, respectively. The patients have been doing well for 64, 22, and 23 months, respectively.

In rare tumors of the esophagus, we identified the overall survival as 28.4±5.4 months and the three and five-year survival rates as 26.7% and 15.3%, respectively (Figure 1). We found that the most important variable affecting survival in these tumors is performing esophagectomy. The overall survival in patients who underwent esophagectomy was 45.6±8.6 months, and the three and five-year survival rates were 50.2% and 28.7%, respectively. However, in patients who did not undergo esophagectomy, the overall survival was 10.6±2.2 months and the three-year and annual survival rates were 5.6% and 0%, respectively. In terms of survival, a statistically significant difference was shown between those who underwent and did not undergo esophagectomy ($p<0.05$) (Figure 2). In patients whose pathological staging was performed after esophagectomy, we calculated the median survival period as 43.3±32.9 months at stage 2A, 32.6±25.8 months at stage 2B, and 15.0±7.7 months at stage 3.

The overall survival periods in females and males were 37.1±8.1 months and 15.2±3.7 months, respectively, and no significant difference was found between sexes in terms of survival ($p=0.06$). The mean survival was

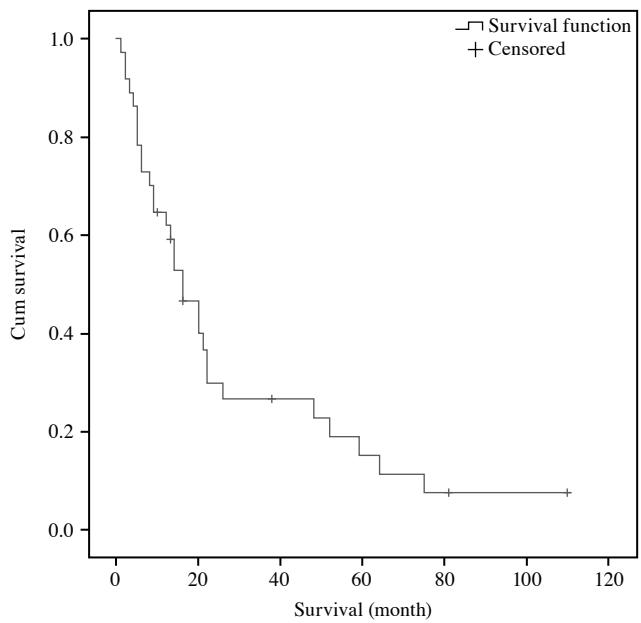

Figure 1. Overall survival curve.

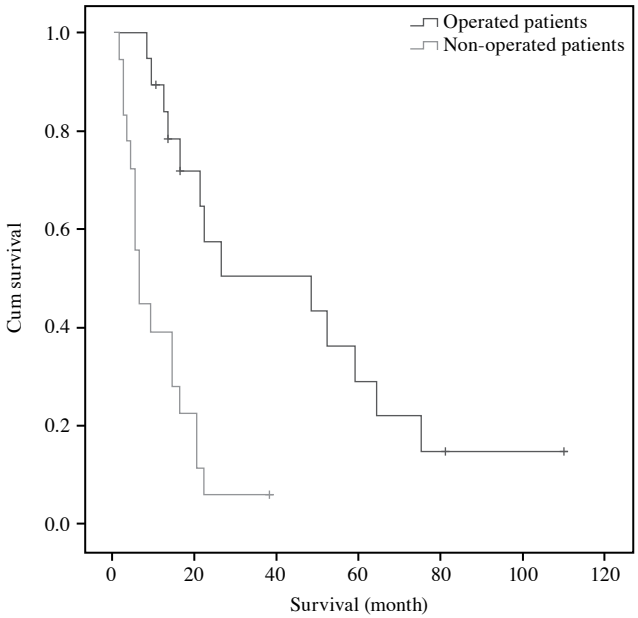

Figure 2. Overall survival curve of patients who had and had not undergone esophagectomy.

29.0±5.6 months in patients over the age of 40 and 11.3±3.0 months in patients aged 40 and lower. However, no statistically significant difference was detected between these two groups (p>0.05). There was no statistically significant difference in survival when we compared patients with adenosquamous cell carcinoma to all other patients with rare tumors. Moreover, no statistically significant difference was found between tumor localizations and survival (p>0.05). We reported the median survival and five-year survival rates in distal adenocarcinoma and squamous cell carcinoma between January 1999 and July 2010.[11] Mean survival was 34.3 months in adenocarcinoma and 30.5 months in squamous cell carcinoma. Five-year survival rates were 33.3% and 17.1% in adenocarcinoma and squamous cell carcinoma, respectively (p=0.55). When we compared adenocarcinoma and squamous cell carcinoma, we observed that the mean and five-year survival rates in unusual variants were similar to that of squamous cell carcinoma.

DISCUSSION

Diagnostic methods and surgical techniques in unusual variants of primary malignant esophageal tumors were the same as in squamous cell carcinoma and adenocarcinoma of the esophagus.

Adenosquamous cell carcinomas of the esophagus are malignant tumors which have histologically granular and squamous components.[12] In routine microscopic examination and hematoxylin, and eosin staining, these tumors have at least 20% squamous cell carcinoma and adenocarcinoma component.[13] Due to their rarity, clinical features of these tumors and their responses to treatment are not exactly known. In general, they were reported at a rate of 0.5-1% among all esophageal cancers in series.[14] This rate was 1.9% in our center. Compared to all rare esophageal tumors, this ratio was 51.3%. Esophagectomy was performed on eight of these patients (42.1%) and all of the remaining patients received chemoradiotherapy. After chemoradiotherapy, self-expandable metallic esophageal stent was inserted to three patients with continuing dysphagia. In the literature, the average survival in these tumors was reported to be 36 months, while the three and five-year survival rates were reported to be 48.5% and 19.4%, respectively.[14] In our series, the median survival was 27.8±7.5 months and the three and five-year survivals were 28.9% and 14.5%, respectively. Compared to the non-rare tumors of the esophagus, the survival rate and clinical course in these tumors were reported to be worse.[14] In our series, when we compared the adenosquamous cell carcinoma with all other patients with rare tumors, we found no statistically significant difference in terms of survival (p>0.05).

The rate of incidence of neuroendocrine cell carcinomas of the esophagus is 1.3% among all gastrointestinal neuroendocrine tumors.[15] The most common symptom of this tumor, which is more common in males, is dysphagia.[15] Since esophageal mucosal glands are mainly localized in the distal esophagus, these tumors are usually seen in this area.[16] However, it was shown in a community-based study that, in patients with high-grade esophageal neuroendocrine carcinoma, the tumors were usually localized in mid-esophagus.[17] In the same study, it was shown that the patients were mainly composed of older and smoker males. The most important factor that affects survival in these tumors is the presence of lymph node metastasis.[18] The presence of lymph node metastasis at the time of diagnosis is approximately 57%.[15] The mean survival after esophagectomy is 28.5 months, and the three and five-year survival rates are 61% and 25%, respectively.[17] In our series, there were nine patients with neuroendocrine carcinoma (0.9%). The mean age of these patients was 61.3 years (range 41 to 87 years) and the number of male patients was higher (55.5%). The tumor was localized in the distal esophagus in eight patients and in the medium esophagus in one patient. The most common symptom was dysphagia (100%, n=9). Two patients who underwent esophagectomy were at stage IIA and

stage III, respectively. The mean survival in this group was 11.5±3.1 months.

Basaloid squamous cell carcinomas are a rare and poorly differentiated variant of typical squamous cell carcinomas.[19] It usually appears in larynx, tongue and hypopharynx.[20] Although its exact incidence is still unknown, it was reported to be detected at a rate of 0.068-11.3% in all esophageal cancers.[21] Its clinical features are the same as those of the esophageal squamous cell carcinoma. They are usually located in the middle and lower esophageal region. Its standard treatment regimens are the same as those of the squamous cell and adenocarcinoma of the esophagus. It is usually observed at the sixth decade and the mean survival time is 29.0 months.[21] Among the treatment options are esophagectomy, esophagectomy after neoadjuvant therapy, adjuvant chemotherapy and/or radiotherapy, esophageal stent and definitive chemoradiotherapy. In our series, four patients had basaloid squamous cell carcinoma (%0.4). The mean age was 59.2 years (range 36 to 71 years) and all patients were female. The tumor was localized in the distal esophagus in two patients and in the medium esophagus in the other two patients. The most frequent symptom was dysphagia (100%, n=4). All patients in this group underwent esophagectomy. Their pathologic stages were stage IIA in two patients, stage IIB in one patient, and stage III in one patient. The mean survival of these patients was calculated as 35.3±11.9 months.

Carcinosarcoma of the esophagus are tumors which are usually seen in middle and older age groups and often localized in the mid-esophagus.[22] Diagnosis and treatment methods of these tumors are the same as those in the squamous cell and adenocarcinomas of the esophagus. Since these tumors usually grow rapidly towards the esophageal lumen, they give symptoms in the early period.[23] Thus, these patients may be diagnosed earlier. The three and five-year survival rates are 63% and 27%, respectively, and early diagnosis of these tumors provide advantage in the three-year survival.[24] In our series, there were two patients with carcinomas (0.2%). Both patients were female and were 60 and 75 years old, respectively. Dysphagia was present in both patients, one of whom also had fatigue and weight loss. In both patients, the tumor was in the mid-esophagus. Pathological stages of the patients who underwent esophagectomy were IIB and III. The 60-year-old patient with stage IIB tumor has been alive for 81 months. The other patients have been doing well for eight months.

Mucoepidermoid carcinomas usually originate from the upper airways and salivary glands.[25] These tumors, which are believed to originate from submucosal glands in the esophagus, are very rare.[26] Their rate of incidence is 0.05% to 2.2% in all primary esophageal cancers.[26-28] Curative or palliative surgery, chemotherapy and radiation therapy can be implemented in the treatment of these tumors.[29] The most important factor in survival is the tumor stage at the time of diagnosis. Although the most common symptom in these tumors is dysphagia, retrosternal pain, nausea, vomiting and weight loss can also be seen. The diagnostic value of the preoperatively-taken endoscopic biopsies is low.[29] In our series, there was an 82-year-old female patient with mucoepidermoid carcinoma of the esophagus (0.1%). In the patient with dysphagia complaint, the tumor was localized in the mid-esophagus. Tumor cells were observed in the endoscopic biopsy taken in the preoperative period; however, no definitive diagnosis was made. The postoperative stage of the patients who underwent esophagectomy was IIA. The definitive diagnosis was made after histopathological examination of the surgical specimen. The survival time of the patient was 64 months.

Adenoid cystic carcinomas are generally observed in the salivary glands, upper respiratory tract, lacrimal gland and breast tissue.[30] Its rate of incidence is about 0.1% in all esophageal tumors.[30] The mean age in these tumors is 65 and they are more common in males.[31] Initial symptoms are often in the form of dysphagia. These tumors typically originate from the mid-esophagus form an ulcerative lesion. In these tumors, a definitive diagnosis may not be established in the endoscopic biopsies taken in the preoperative period due to small biopsy material.[30] The effectiveness of radiation and chemotherapy is low in these tumors, primary treatment of which is resection.[31] Five-year survival is about 35%.[32] In our series, there was a 59-year-old female patient with adenoid cystic carcinoma (0.1%). Although malignant cells were seen in the endoscopic biopsy -taken in the preoperative period- of the patient with initial complaint of dysphagia, no final pathological diagnosis was made. The patient underwent esophagectomy. The definitive diagnosis was made after histopathological examination of the surgical specimen. Its postoperative stage was I and the survival time was 22 months.

Leiomyosarcoma of the esophagus is the most common sarcoma type.[33] It constitutes 0.5% of all esophageal sarcoma and 5% of all gastrointestinal carcinomas.[34] Association of esophageal

leiomyosarcoma and squamous cell carcinoma is, however, extremely rare in the literature.[35] Such association was first defined by Ovens et al.[36] in 1951. Leiomyosarcomas of the esophagus have a slow growth pattern.[35] The treatment opted for the patients with simultaneous tumors should be surgery. In our series, there was a 46-year-old male patient with esophageal leiomyosarcoma and simultaneous squamous cell carcinoma (0.1%). In the patient with dysphagia and retrosternal chest pain complaints, both tumors were localized in the medium esophagus. In endoscopic biopsies taken in the preoperative period, only squamous cell carcinoma diagnosis was made. As a result of the histopathological examination of the surgical specimen, simultaneous leiomyosarcomas were detected. The survival time of the patient, whose postoperative stage was IIA, was 23 months.

The limitations of this study included retrospective design and single-centre setting.

In conclusion, rare primary tumors of the esophagus show similarities with adenocarcinoma and squamous cell carcinoma of the esophagus in terms of symptoms, diagnosis methods, treatment options, and survival. However, due to their rarity, their treatment algorithms, clinical features and biological behaviors have not yet been clearly identified. Today, the most effective option in the treatment of these tumors, which have no standard staging system and treatment algorithms yet, is esophagectomy at an early stage.

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REFERENCES

1. Szumiło J, Dabrowski A. Primary esophageal malignant melanoma. Pol J Pathol 2011;62:148-51.
2. Chen S, Chen Y, Yang J, Yang W, Weng H, Li H, et al. Primary mucoepidermoid carcinoma of the esophagus. J Thorac Oncol 2011;6:1426-31.
3. Chen WS, Zheng XL, Jin L, Pan XJ, Ye MF. Novel diagnosis and treatment of esophageal granular cell tumor: report of 14 cases and review of the literature. Ann Thorac Surg 2014;97:296-302.
4. Maru DM, Khurana H, Rashid A, Correa AM, Anandasabapathy S, Krishnan S, et al. Retrospective study of clinicopathologic features and prognosis of high-grade neuroendocrine carcinoma of the esophagus. Am J Surg Pathol 2008;32:1404-11.
5. Francioni F, Tsagkaropoulos S, Telha V, Barile La Raia R, De Giacomo T. Adenosquamous carcinoma of the esophagogastric junction. Case report. G Chir 2012;33:123-5.
6. Kai Y, Kato M, Hayashi Y, Akasaka T, Shinzaki S, Nishida T, et al. Esophageal early basaloid squamous carcinoma with unusual narrowband imaging magnified endoscopy findings. World J Gastroenterol 2014;20:12673-7.
7. Zhang BH, Zhang HT, Wang YG. Esophageal leiomyosarcoma: clinical analysis and surgical treatment of 12 cases. Dis Esophagus 2014;27:547-51.
8. Ogasawara N, Tamura Y, Funaki Y, Yamaguchi Y, Shimozato A, Yanamoto K, et al. Rapidly growing esophageal carcinosarcoma reduced by neoadjuvant radiotherapy alone. Case Rep Gastroenterol 2014;8:227-34.
9. Zhou Y, Zang Y, Xiang J, Tang F, Chen Z. Adenoid cystic carcinoma of the cardia: Report of a rare case and review of the Chinese literature. Oncol Lett 2014;8:726-30.
10. Thomas W. Rice Staging of esophageal cancer: TNM and beyond. Esophagus 20107:189-95.
11. Eroglu A, Aydın Y, Yılmaz O, Ulas AB. An outcome comparison of adenocarcinoma of the esophagus to squamous cell carcinoma after transthoracic esophagectomy. Turk Gogus Kalp Dama 2013;21:402-7.
12. Chen SB, Weng HR, Wang G, Yang JS, Yang WP, Liu DT, et al. Primary adenosquamous carcinoma of the esophagus. World J Gastroenterol 2013;19:8382-90.
13. Japan Esophageal Society. Japanese classification of esophageal cancer, tenth edition: part II and III. Esophagus 2009;6:71-94.
14. Zhang HD, Chen CG, Gao YY, Ma Z, Tang P, Duan XF, et al. Primary esophageal adenosquamous carcinoma: a retrospective analysis of 24 cases. Dis Esophagus 2014;27:783-9.
15. Lee CG, Lim YJ, Park SJ, Jang BI, Choi SR, Kim JK, et al. The clinical features and treatment modality of esophageal neuroendocrine tumors: a multicenter study in Korea. BMC Cancer 2014;14:569.
16. Bennouna J, Bardet E, Deguiral P, Douillard JY. Small cell carcinoma of the esophagus: analysis of 10 cases and review of the published data. Am J Clin Oncol 2000;23:455-9.
17. Huang Q, Wu H, Nie L, Shi J, Lebenthal A, Chen J, et al. Primary high-grade neuroendocrine carcinoma of the esophagus: a clinicopathologic and immunohistochemical study of 42 resection cases. Am J Surg Pathol 2013;37:467-83.
18. Fricker J. Survival prediction with neuroendocrine differentiation? Lancet Oncol 2006;7:891.
19. Imamhasan A, Mitomi H, Saito T, Hayashi T, Takahashi M, Kajiyama Y, et al. Immunohistochemical and oncogenetic analyses of the esophageal basaloid squamous cell carcinoma in comparison with conventional squamous cell carcinomas. Hum Pathol 2012;43:2012-23.
20. Wang LC, Wang L, Kwauk S, Woo JA, Wu LQ, Zhu H, et al. Analysis on the clinical features of 22 basaloid squamous cell carcinoma of the lung. J Cardiothorac Surg 2011;6:10.
21. Chen SB, Weng HR, Wang G, Yang JS, Yang WP, Li H, et al. Basaloid squamous cell carcinoma of the esophagus. J Cancer Res Clin Oncol 2012;138:1165-71.

22. Zia-ur-Rehman, Pal I, Ahmed Z, Qureshi A. Carcinosarcoma of the esophagus. J Coll Physicians Surg Pak 2010;20:282-4.
23. Gaur DS, Kishore S, Saini S, Pathak VP. Carcinosarcoma of the oesophagus. Singapore Med J 2008;49:283-5.
24. Iyomasa S, Kato H, Tachimori Y, Watanabe H, Yamaguchi H, Itabashi M. Carcinosarcoma of the esophagus: a twenty-case study. Jpn J Clin Oncol 1990;20:99-106.
25. Fegelman E, Law SY, Fok M, Lam KY, Loke SL, Ma LT, et al. Squamous cell carcinoma of the esophagus with mucin-secreting component. Mucoepidermoid carcinoma. J Thorac Cardiovasc Surg 1994;107:62-7.
26. Matsufuji H, Kuwano H, Ueo H, Sugimachi K, Inokuchi K. Mucoepidermoid carcinoma of the esophagus--a case report. Jpn J Surg 1985;15:55-9.
27. Ozawa S, Ando N, Shinozawa Y, Ohmori T, Kase K, Sato T, et al. Two cases of resected esophageal mucoepidermoid carcinoma. Jpn J Surg 1989;19:86-92.
28. Koide N, Hamanaka K, Igarashi J, Hanazaki K, Adachi W, Hosaka S, et al. Co-occurrence of mucoepidermoid carcinoma and squamous cell carcinoma of the esophagus: report of a case. Surg Today 2000;30:636-42.
29. Turkyilmaz A, Eroglu A, Gursan N. Muco-epidermoid carcinoma of the oesophagus: a case report. Acta Chir Belg 2009;109:416-8.
30. Karaoglanoglu N, Eroglu A, Turkyilmaz A, Gursan N. Oesophageal adenoid cystic carcinoma and its management options. Int J Clin Pract 2005;59:1101-3.
31. Petursson SR. Adenoid cystic carcinoma of the esophagus. Complete response to combination chemotherapy. Cancer 1986;57:1464-7.
32. Na YJ, Shim KN, Kang MJ, Jung JM, Ha CY, Jung HS, et al. Primary esophageal adenoid cystic carcinoma. Gut Liver 2007;1:178-81.
33. Goldberg A. Less common malignant tumors of the esophagus. In: Shields TW, editor. General Thoracic Surgery. 7th ed. Philadelphia: Lippincott Williams & Wilkins; 2009. p. 2041-50.
34. Dougherty MJ, Compton C, Talbert M, Wood WC. Sarcomas of the gastrointestinal tract. Separation into favorable and unfavorable prognostic groups by mitotic count. Ann Surg 1991;214:569-74.
35. Eroğlu A, Kürkçüoğlu C, Karaoğlanoğlu N, Erdoğan F, Polat P. Simultaneous leiomyosarcoma and squamous cell carcinoma of the esophagus: report of a new case. Dis Esophagus 2001;14:245-6.
36. Ovens JM, Russell WO. Concurrent leiomyosarcoma and squamous carcinoma of the esophagus. AMA Arch Pathol 1951;51:560-4.